125 respectively, the illuminating powers of the two telescopes are inferred to be as 678 to 290.

The mean of this and the two former experiments, without making allowance for the imperfect polish of the Cassegrainian in one of them, gives the comparative superiority in the illuminating power of the Cassegrainian more than 2 to 1; or if the experiment which the author considers less perfect be rejected, it would appear to be 2¼ to 1 in favour of the Cassegrainian construction.

Astronomical Observations relating to the sidereal part of the Heavens, and its Connexion with the nebulous part; arranged for the purpose of a critical Examination. *By* William Herschel, *LL.D. F.R.S.* Read February 24, 1814. [*Phil. Trans.* 1814, *p.* 248.]

In a former communication to the Society, the author endeavoured to show the probability of a progressive condensation of nebulous matter, so as to put on ultimately the appearance of stars: his present object is to show, by reference to select cases from many thousand former observations on record, that a similar operation of gradual condensation is also taking place among condensed clusters of visible stars, and consequently to render it probable that an intimate connexion subsists between these extremes, and that the same process of condensation continues from one end of the series to the other; so that the most perfect stars may possibly have originated from an accumulation of mere nebulous matter.

His first observations, indeed, relate to a more direct communication between present stars and contiguous nebulosity in different relative positions. In some instances a single star appears to be attracting to itself a branch of nebulosity, seen extending from one of its sides; in others, two adjacent stars appear to have equal power over a linear portion of nebula that extends from one to the other.

The portions of nebula, however, that are adjacent to different single stars, vary considerably in their appearance. Of those nebulous branches that extend only on one side, some have parallel sides, some are fan-shaped, others are in a considerable degree irregular. Some stars have extended nebulosity on opposite sides, in a line of which they occupy the centre. Round others it appears diffused equally, as in a globular form, on all sides; and in some instances, such a globular nebula apparently includes a cluster of several stars together. All these appearances afford a presumption, that stars and nebulæ are drawn together by mutual attraction, and that the accession of such a quantity of matter as must be contained in an extensive nebula will ultimately cause what may be called the *growth* of stars. What in its first state appeared as a globular nebula alone, would, by condensation, present the appearance of a nucleus in its centre. The globular nebula with nucleus would, by increasing condensation, become a nebulous star; its next state would be that of a distinct star, with surrounding nebulosity; and the last result would be the perfect simple star.

The author observes, however, that in the instances which present themselves of such connexion between stars and nebulæ, which are the two extremes of the series, the nebulosity may not always be a remnant of the unsubsided nebulous matter from which they were originally formed, but detached portions of nebulous matter may, like stars, have a considerable proper motion, and may be intercepted in their course by clusters of stars, or by the more powerful attraction of a single star of great magnitude, by which they will in still less time be absorbed. In Dr. Herschel's endeavours to arrange the vast accumulation of observations already recorded on this subject, there are many phenomena too ambiguous to admit of classification; but this, he observes, will necessarily occur at every period in the progressive improvement of telescopes; since a greater power of penetrating into space, which would be sufficient to render all present objects distinct, would bring into view a still greater number of appearances, requiring a still further extension of our powers to comprehend.

After arranging the various instances of gradation in which nebulosity appears successively more and more condensed, whether with or without intervening stars, the author examines aggregations of stars alone, referring to many former observations of patches of stars, which, at the time of recording them, he was induced to call *forming clusters*, in consequence of some appearances of a tendency to approach, which he inferred from the greater density of such clusters toward their centre. This apparent propensity to cluster seemed chiefly visible in parts of the heavens extremely rich in stars; and Dr. Herschel refers to about 150 instances of such an appearance in the Milky Way, but generally of an irregular form, and very imperfectly collected. Of other clusters, in which more of regularity is observable, a more particular description is given.

The various degrees of compression of different clusters are also noticed, with references to numerous instances by classes in which they are now arranged. Some of these are visible with ordinary telescopes; others are selected as fine objects for good telescopes; and others again, on account of their higher compression, cannot be resolved without the aid of very superior telescopes.

The form, also, of those most compressed is observed to partake more or less of a spherical form. Thirty-nine instances are quoted in which the form is oval in various degrees. But objects of this description can hardly be seen to advantage without a twenty-feet telescope. Others again, and very numerous, are referred to, discovered as globular nebulæ with common telescopes, but resolved into stars by telescopes of high magnifying as well as space-penetrating power; and as these are accordingly but little known, Dr. Herschel selects, from numerous observations that he has made during four-and-thirty years, various nebulæ, classed according to the telescopes with which he had observed them, as a guide to those who may wish to view them, that they may be able to judge which objects may possibly be within the power of the telescopes they happen to possess.

Since the luminous appearance of the Milky Way is caused by stars that are invisible to the naked eye, this part of the heavens presents a vast field for observation on the existence of a clustering power. To the naked eye it is visibly divided into large patches; and a telescope shows it to be still further subdivided into unequal groups, which, though now not completely detached, it is presumed will hereafter become insulated; so that the Milky Way will finally be broken up, and cease to be a stratum of clustered stars.

The same mode of reasoning that leads the imagination to conceive the progressive changes of its future existence, involves also the supposition of its origin at some period certainly very remote, but which it may possibly be in the power of *future* astronomers to estimate, by means of accurate observations on the rate of those changes that may be discovered to have taken place in the course of ages yet to come.

With respect, however, to the extent in space of that portion of infinity through which any objects are discernible, and the arrangement and relative distances of all celestial bodies yet observed, the author is of opinion, that some *present* judgement may be formed; and he is now engaged in a series of observations, with a view to investigate the visible extent of the universe.

On a new principle of constructing His Majesty's Ships of War. By Robert Seppings, *Esq. one of the Surveyors of His Majesty's Navy. Communicated by the Right Hon. Sir* Joseph Banks, *Bart. K.B. P.R.S.* Read March 10, 1814. [*Phil. Trans.* 1814, *p.* 285.]

After remarking upon the length of time that has elapsed since any considerable improvement has taken place in the art of ship-building, and the causes that appear to have prevented amendments being introduced, the author gives a general outline of the structure of ships, as hitherto built, which he represents as consisting generally of pieces of timber or plank, all placed nearly at right angles to each other. For, first, the ribs rise at right angles to the keel. The ribs are crossed, on their inner as well as outer side, with planks at right angles to them, and parallel to the keel. And within the inner linings are also a secondary series of ribs, called riders, at some distance from each other, parallel to the former set, and at right angles to the keel. Across this fabric are placed beams, connecting the opposite sides of the vessel; and these also are at right angles to all the parts before mentioned. From beam to beam, at right angles, are the carlings, which support joists parallel to the beams, on which are laid the planks of the deck, in a right line from head to stern, and accordingly preserving uniform adherence to the parallel and rectangular structure, which in every other instance of carpentry is known to every common mechanic to be the weakest form in which any number of lines can be framed together, as it affords no check to that bending of the materials to which they are liable in the direction of their greatest length. To this cause is to be ascribed the well-known